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(12) **United States Patent**
Longyear

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(54) **SPRING CYCLE COUNTER**

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G06M 1/04	(2006.01)
G06M 1/08	(2006.01)
G06K 7/10	(2006.01)
G06K 7/14	(2006.01)

(Continued)

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CPC ***E05D 13/1269*** (2013.01); *E05Y 2201/484* (2013.01); *E05Y 2400/82* (2013.01); *E05Y 2800/404* (2013.01); *E05Y 2400/10* (2013.01); *E05F 15/00* (2013.01); *E05Y 2800/00* (2013.01); *E05Y 2900/132* (2013.01)

USPC ..... **235/91 R**; 235/454

(58) **Field of Classification Search**

CPC G07C 9/00182; G07C 2009/00928; G07C 2009/00253; G07C 2209/62; G07C 2009/00785; G07C 2009/0092; G07C 2209/08; G07C 9/00174; G07C 9/00912; G07C 2209/64; G07C 9/00; G07C 9/00682; E05Y 2900/106; E05Y 2800/00; E05Y 2201/656; E05Y 2201/668; E05Y 2400/80; E05Y 2900/132; E05Y 2201/22; G05D 2201/0213; G07F 19/0092; G07F 9/026; G07F 11/002; G07F 17/12; G07F 7/00; G07F 11/42; G07F 11/46; G07F 11/62; G07F 11/00; G07F 11/54; G07F 1/046; G07F 5/18; G07F 9/06; G07F 11/165; G07F 11/36; G07F 11/70; G07F 11/10; G07F 11/24

USPC ..... 235/91 R; 340/426.23; 318/266; 49/31

See application file for complete search history.

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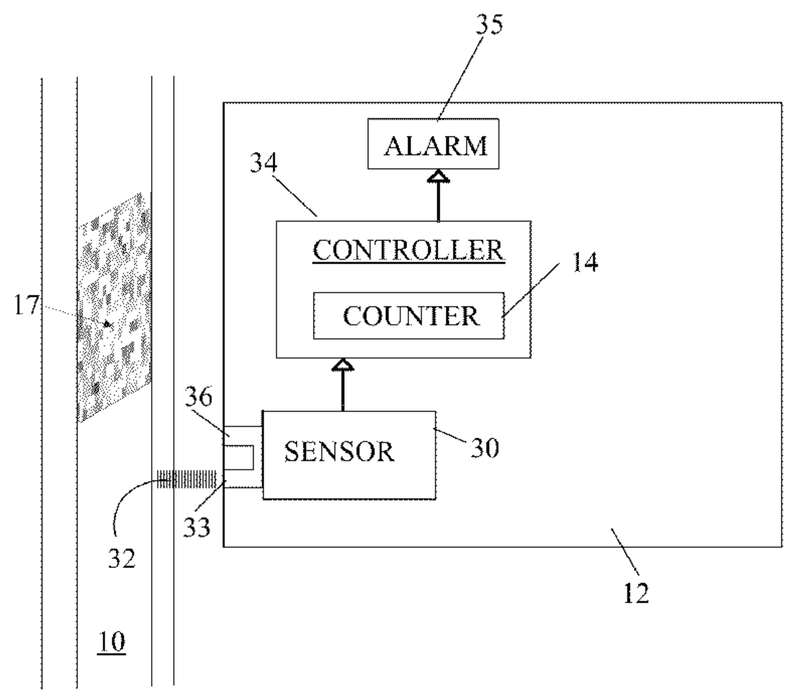
(57) **ABSTRACT**

A spring cycle tracker system for a door mounted on a track having at least one spring, with the door having an open and closed position. The system has at least one sensed element and a tracker. The tracker has a sensor having at least one sensing element; and a controller having a counter, at least one input signal from the at least one sensing element and at least one output signal. The sensed element and the tracker are mounted such that when the door is moved towards the open position and/or the closed position, the sensed element and the controller are moved adjacent to each other so that the sensing element senses the sensed element, sending an input signal to the controller, incrementing the counter, tracking a number of times the spring is used.

13 Claims, 4 Drawing Sheets



(51) **Int. Cl.**

E05D 13/00	(2006.01)
E05F 15/00	(2006.01)

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Fig. 1

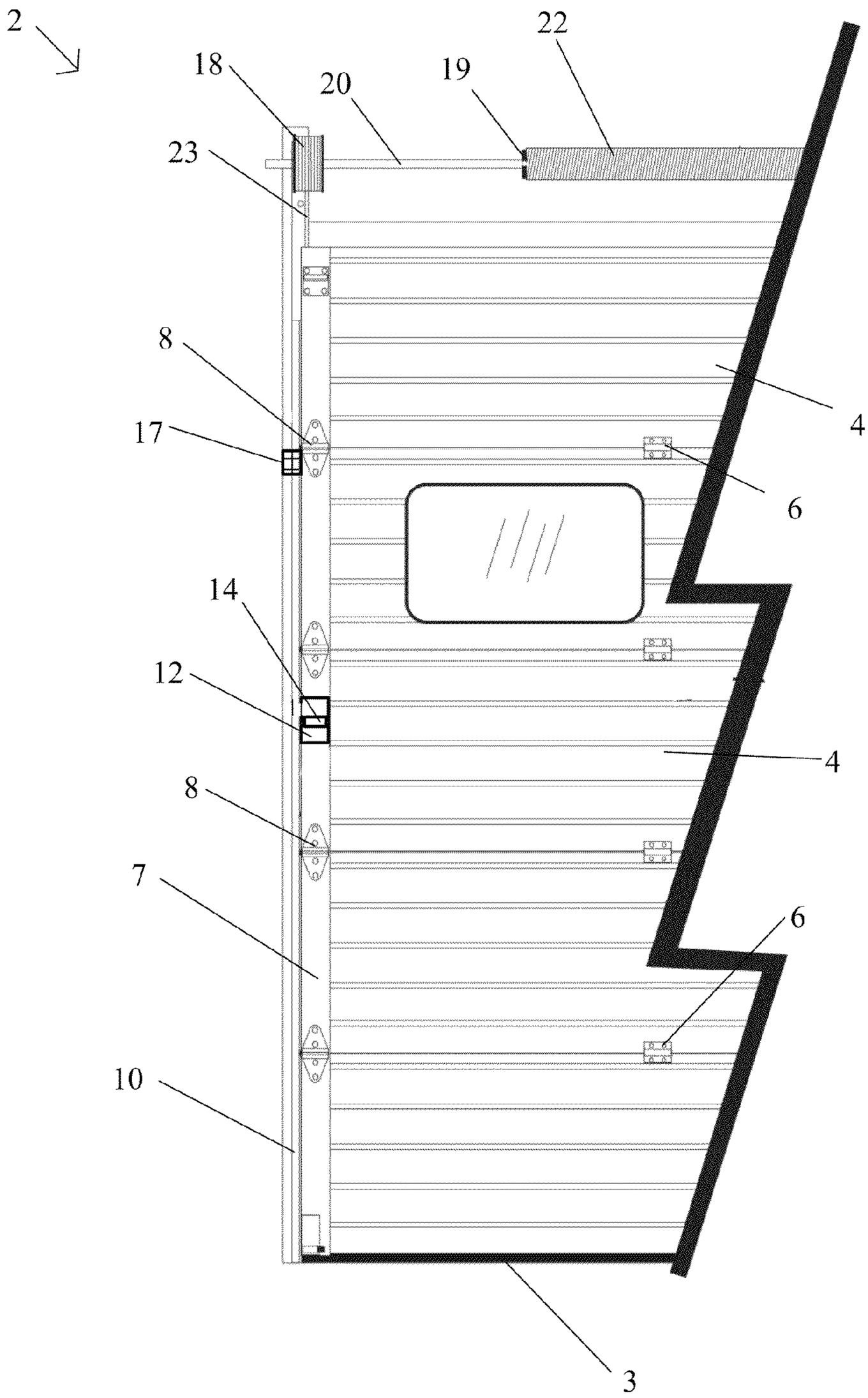


Fig. 2

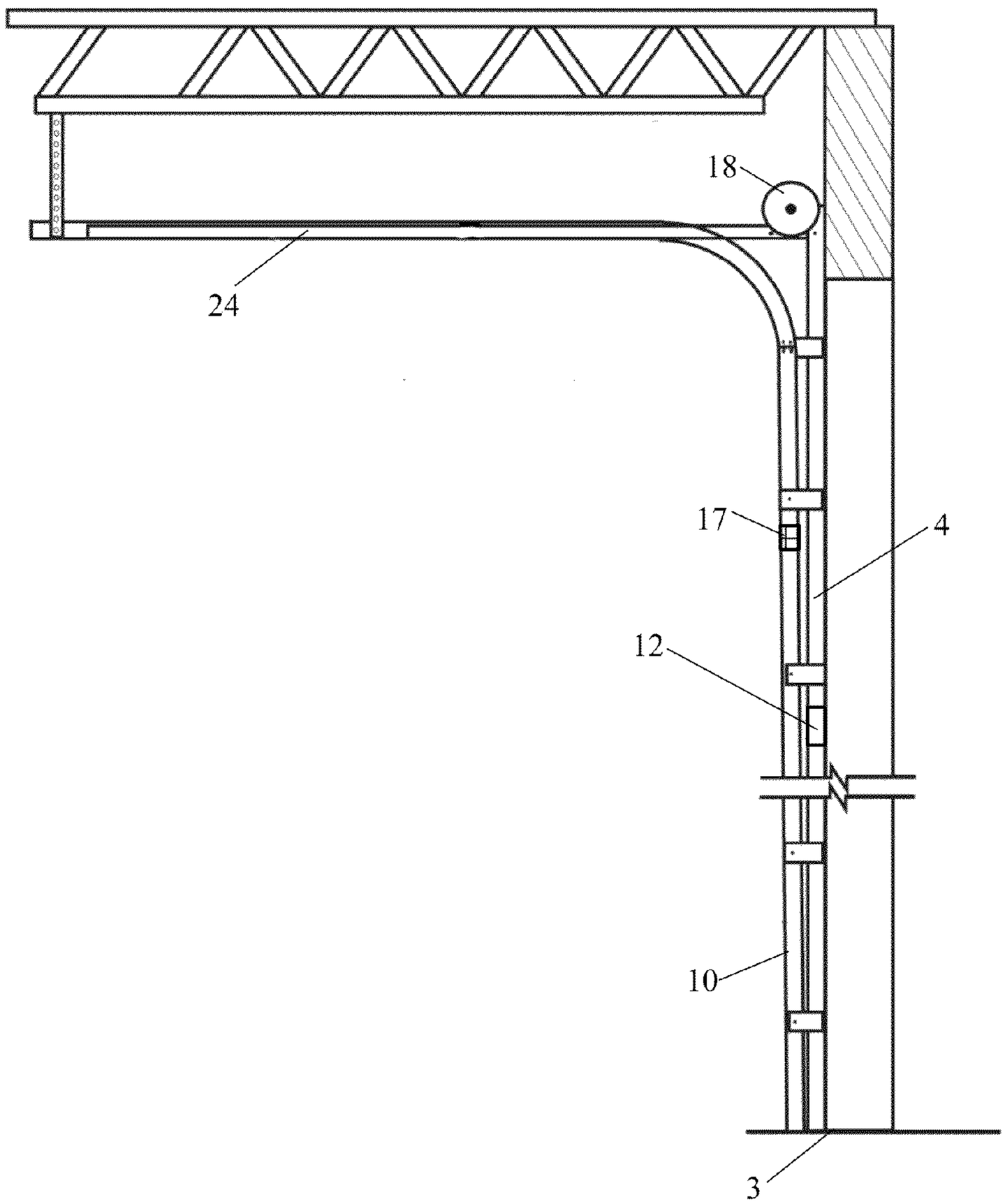


Fig. 3

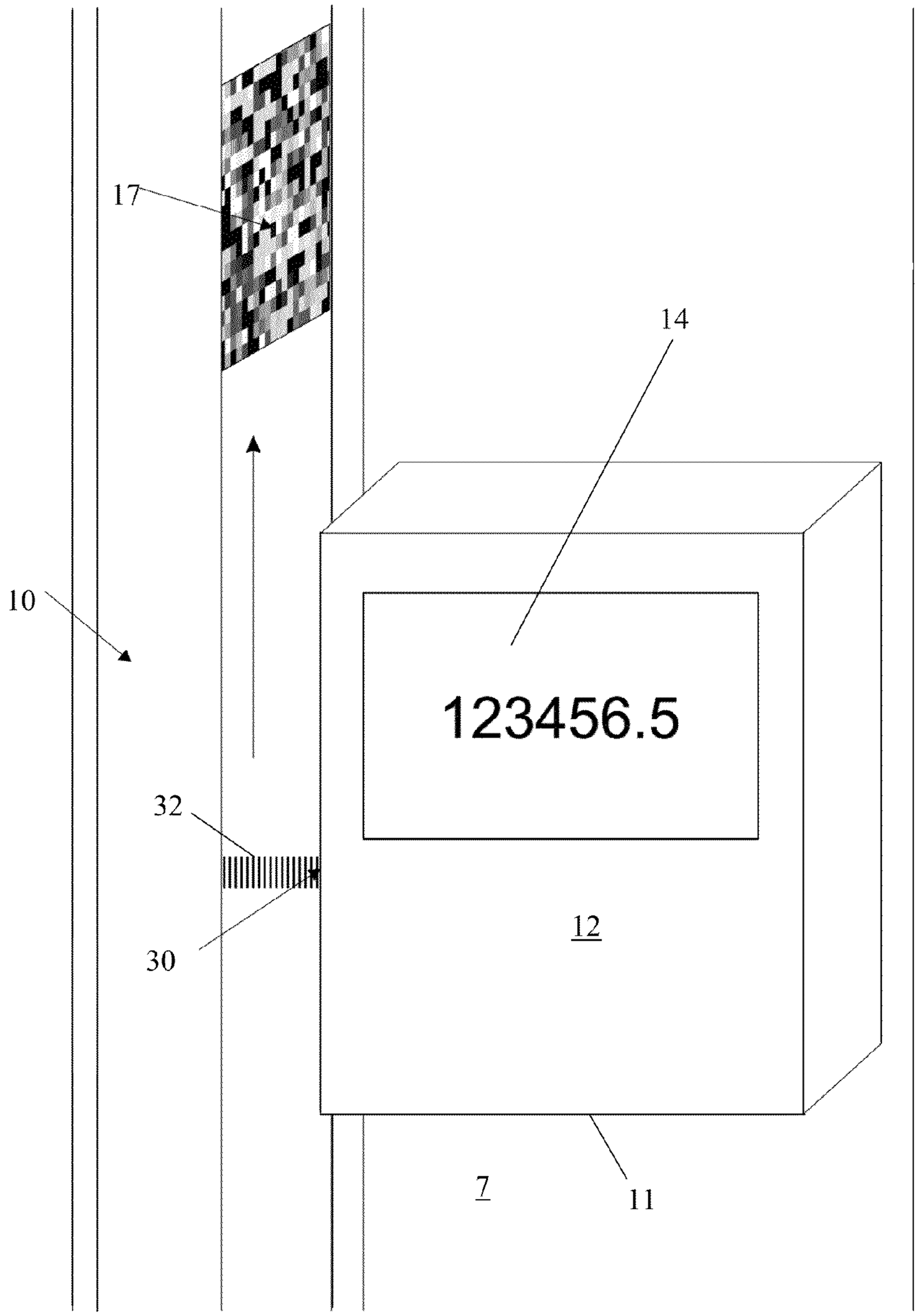


Fig. 4

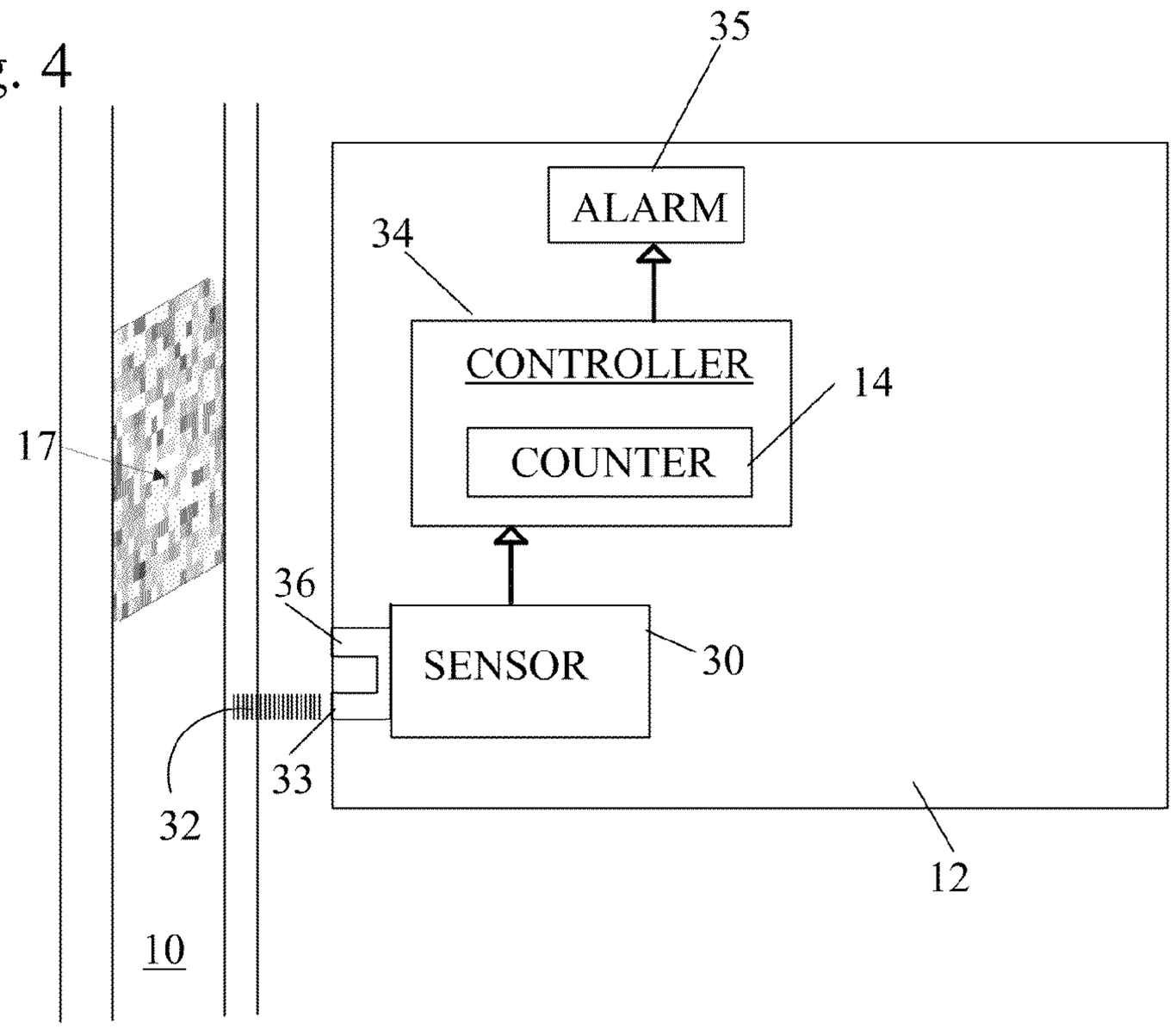
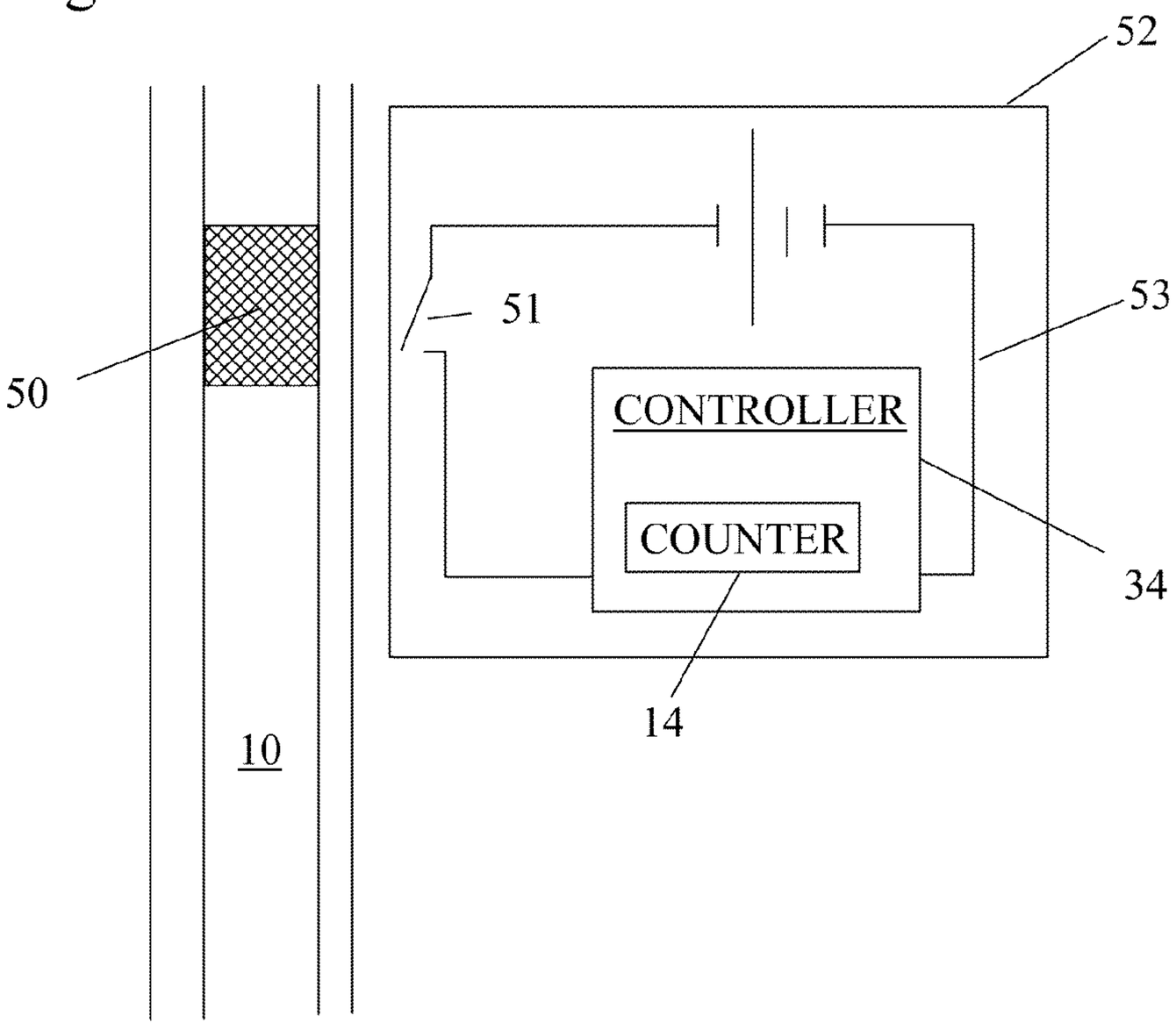

35
ALARM
34
CONTROLLER
14
COUNTER
17
36
SENSOR
30
33
32
12
10

Fig. 5


52
51
53
50
CONTROLLER
COUNTER
34
14
10

SPRING CYCLE COUNTER

REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of copending parent patent application Ser. No. 12/835,992, filed Jul. 14, 2010, entitled "DOOR CYCLE TRACKER". The aforementioned application is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention pertains to the field of spring cycle trackers. More particularly, the invention pertains to a spring cycle tracker for an overhead door.

2. Description of Related Art

Many residential homes and businesses use overhead doors. Springs are used to aid in opening and closing overhead doors. The springs are very tightly tensioned. Most springs used with overhead doors have a life of about 10,000 cycles or about 10 years of normal use, with each spring cycle being equal to one opening and one closing of an overhead door or a door cycle. A breaking spring that is not properly contained may lash out and strike people and or damage property. Currently, there is no way track the life cycle of the spring so that the springs can be properly replaced prior to them breaking and possible injuring people and property.

SUMMARY OF THE INVENTION

A spring cycle tracker system for a door mounted on a track having at least one spring and the door having an open and closed position. The system has at least one sensed element and a tracker. The tracker has a sensor having at least one sensing element; and a controller having a counter, at least one input signal from the at least one sensing element and at least one output signal. The sensed element and the tracker are mounted such that when the door is moved towards the open position and/or the closed position, the sensed element and the controller are moved adjacent to each other so that the sensing element senses the sensed element, sending an input signal to the controller, incrementing the counter, tracking a number of times the spring is used. The sensed element and the tracker are mounted at a height greater than 50% of the total height of the door when the door is in the closed position.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** shows a section of an interior elevation of a sectional overhead door in a closed position.

FIG. **2** shows a side view of the interior of a sectional overhead door in a closed position.

FIG. **3** shows a schematic of the cycle tracker and the overhear door moving towards an open position.

FIG. **4** shows a schematic of a control scheme to actuate the counter of the cycle tracker.

FIG. **5** shows an alternative cycle tracker.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **1-2** show an overhead door **2** in the closed position with a cycle tracker **12** of the present invention. The overhead door **2** includes a series of sections **4** that are connected to each other by hinges **8** near the outer edge **7** of the door and another set of hinges **6** between the sections **4** and the outer edges **7**. It should be noted that only one set of hinges **8** on the outer edge **7** and one set of hinges **6** between the outer edges **7** are shown in FIG. **1**. Additional hinges may be present.

Above the overhead door is mounted a torsion spring counterbalance system. The torsion spring counter balance system includes a torsion spring **22** on a torsion shaft **20** mounted over the overhead door with a winding cone **19** on one end and a stationary cone (not shown) at the other end. At the ends of the torsion shaft **20** are cable drums **18**. Counterbalance cables **23** run from the vertical tracks at the bottom corners of the door to the cable drums **18**.

The outer edges **7** of the sections **4** of the overhead door **2** are mounted on a vertical track **10**. The vertical track **10** transitions into a horizontal track **24** as shown in FIG. **2**. In one embodiment, attached to the vertical track **10** of the overhead door **2** is reflective tape **17** or some other type of reflective material. Attached to an outer edge **7** of one of the sections **4** of the overhead door is a cycle tracker **12**. The cycle tracker **12** tracks the number of door cycles or spring cycles which can be used to predict the remaining life or the remaining number of life cycles of the spring. One spring cycle is equivalent to one door cycle, with each door cycle equal to one opening and closing of an overhead door **2**.

By knowing the approximate life cycle of the spring, through tracking the number of times the spring has been used or the number of cycles that have already taken place through the number of door cycles, the remaining life cycle of the spring may be predicted and the torsion spring can be replaced prior to it breaking or snapping, decreasing the possibility of injuring people and property.

An audible alarm of the cycle tracker **12** may sound a warning, indicating when the torsion spring is approaching a certain percentage of life remaining, or may also be set when the number on the counter exceeds a specific number of spring cycles. For example, the alarm may sound a warning if 20% of the life cycle of the spring remains or if the counter exceeds 8000 spring cycles. Additionally, the cycle tracker **12** may also have, either separately or in conjunction with the audible alarm, a visible alarm in the form of a light to indicate when the counter reaches a specific number of spring or door cycles.

Referring to FIG. **3**, the cycle tracker **12** includes a body or plate **11** that is mounted the outer edge **7** of a section **4** of the overhead door **2**. A counter **14**, which is preferably part of a controller **34**, preferably has at least six digits visible and is actuated to increment by the controller **34**. The controller **34** is not limited to the inputs and outputs shown within the drawings. The counter **14** is preferably resettable and may be digital.

As shown in FIG. **4**, within the cycle tracker **12** is a sensor **30** which contains both an emitter **33** and a sensor receiver **36**. The sensor **30** may be a diffuse-mode sensor, where light emitted from the sensor strikes the surface of an object to be detected (in this case the reflective tape **17**), and is diffused back or sends some light back to the receiver **36**. Therefore, the reflective tape **17** is detected when the beam of light **32** hits the reflective tape **17** and reflects back the sensor's transmitted light energy back to the sensor. Other type sensors, such as a retroreflective sensor, divergent-mode sensors, or convergent-mode sensor may also be used.

When the reflective tape **17** is detected, the sensor **30** sends an input signal to a controller **34**. The controller **34** increases the counter **14** by 0.5. If the number on the counter **14** exceeds a preset number, the controller **34** sends an output signal to an alarm **35**. The alarm **35** may be a visual alarm, an audible alarm or both. Both the alarm **35** and the counter **14** may be resettable.

Looking, then, at a complete door cycle from closed, to open and back to closed, the counter system works as follows:

When the overhead door **2** is raised to an open position, the torsion spring **22** unwinds and the stored tension aids in lifting the sections **4** of the overhead door **2**. The wheels on the sections slide inn the vertical track **10** and transition onto the horizontal track **24**. The spring **22** takes up the weight as the door moves by turning the shaft **20**, thus turning the cable drums **18**, wrapping the cables **23** around the cable drums **18**.

As the overhead door **2** is moving onto the horizontal track **24**, the cycle tracker passes the reflective tape **17**. Light emitted from the sensor **30** of the cycle tracker **12** strikes the reflective tape **17**, and reflects back the sensor's transmitted light energy back to the sensor **30**. The sensor **30** sends an input signal to the controller **34**. The controller **34** increases the counter **14** by 0.5. If the number on the counter **14** exceeds a preset number, the controller **34** sends an output signal to an alarm **35**.

To close the door from the open position described above, the overhead door **2** is lowered to a closed position in which an edge of one of the sections **4** is in contact with the ground **3**. In the closed position the sections **4** of the overhead door **2** are on the vertical track **10**. As the door closes, the cables **18** unwrap from the drums **18** and the torsion spring **22** is rewound to full tension.

As the overhead door **2** is moving towards the closed position, the cycle tracker once again passes the reflective tape **17**. As it does, light emitted from the sensor **30** of the cycle tracker **12** strikes the reflective tape **17**, and reflects back the sensor's transmitted light energy back to the sensor **30**. The sensor **30** sends an input signal to a controller **34**. The controller **34** increments the counter **14** to increase the counter by 0.5. If the number on the counter **14** exceeds a preset number, the controller **34** sends an output signal to an alarm **35**.

Thus for each complete cycle of door opening and door closing, the counter is increased by 0.5 twice—therefore, one complete door cycle of an opening and closing of the door increases the counter by one. One door cycle is equivalent to one spring cycle.

In an alternate embodiment, the cycle tracker may only track when the door is moved to an open position.

The cycle tracker **12** is preferably attached to a section **4** of the overhead door **2** at eye level of a user or greater than 50% of the height of the door when the door is in the closed position.

In another embodiment of the present invention, the spring cycles may be tracked when the door is moving in only one direction (up or down) by placing two separate sensors **30** with two separate sensing or receiving elements **36** at different locations offset from each other. The two receiving elements **36** provide input to a controller **34** within a cycle tracker **12**. In other words, two reflective strips **17** horizontally and vertically offset in the door track **10**, **24** are sensed, and only counted when a first receiving element of a first sensor detects the reflective material before the second receiving element of a second sensor, indicating that the door is moving in a selected direction. When this occurs, the counter is increased by one by the controller **34**.

In another embodiment which would allow the counting to only occur when the door is moving in one direction, the reflective material **17** could be patterned to have non-reflective portions in a specific pattern, such that when a sensor receiver **36** receives transmitted light from the reflective material **17** and the overhead door **2** is moving one way—for example, towards an open position—the sensor **30** would sense light transmitted or reflected in a pattern such as on-off(long)-on-off(short)-on. When overhead door **2** is moving in the other direction—towards a closed position—the light transmitted to the sensor **30** or reflected in a different pattern such as on-off(short)-on-off(long)-on. By being able to determine which way the door is moving, the counter **14** can be incremented either for both opening and closing, or just if the door is moving in one direction, open or closed.

In an alternate embodiment, the reflective material **17** may be replaced by a magnet **50** as shown in FIG. **5**. The counter **14** would be actuated when the overhead door **2** approached the magnet **50** and actuated a switch **51** to complete the circuit **53** within the cycle tracker **52**. A controller **34** includes a counter **14** to monitor the number of door cycles or spring cycles and send a signal to trigger an alarm.

In another embodiment which would allow the counting to only occur when the door is moving in one direction, magnets **50** may be placed horizontally and vertically offset on each door track at different heights, and the counter **14** is only increased when a first sensor detects the magnet before a second sensor detects the magnet.

While the drawings and the discussion above have the cycle tracker **12** mounted on the overhead door **2** and the sensed element (reflective material **17** or magnet **50**) mounted at a fixed location near or to the track, it will be understood that the invention contemplates simply that the two elements be mounted at locations where a moving element (be it the tracker or the sensed element) passes by the fixed element (the other of the sensed element or the tracker). Therefore, the opposite arrangement to that discussed previously is also possible, in which the cycle tracker **12** is mounted to a fixed location adjacent to the door—either on the vertical track **10** or on the horizontal track **24** or at a location adjacent to one of the tracks—and the sensed element is mounted to the moving overhead door **2**. In such an arrangement the sensed element (reflective material **17** or magnet **50**) would be preferably attached to a section **4** of the overhead door **2** at eye level of a user or greater than 50% of the height of the door when the door is in the closed position.

While a digital counter is described, other types of counters that may be electrically or electronically actuated may also be used.

While the cycle tracker **12** was described and shown in reference to an overhead door **2** with a torsion spring counterbalance system, one skilled in the art could be expected to apply the cycle tracker to an overhead door with extension springs.

While the overhead door was shown as being comprised of segments, the door may also be of the type that lifts in one piece.

Accordingly, it is to be understood that the embodiments of the invention herein described are merely illustrative of the application of the principles of the invention. Reference herein to details of the illustrated embodiments is not intended to limit the scope of the claims, which themselves recite those features regarded as essential to the invention.

What is claimed is:

1. A spring cycle tracker system for a door mounted on a track having at least one spring, the door having an open position and closed position, the system comprising:

at least one sensed element of a reflective material comprising a reflective portion and a non-reflective portion;

a spring cycle tracker comprising:

a sensor having at least one sensing element; and

a controller having a counter, at least one input signal from the at least one sensing element and at least one output signal;

wherein the sensed element and the spring cycle tracker are mounted such that when the door is moved towards the

open position and/or towards the closed position, the sensed element and the controller are moved adjacent to each other so that the sensing element senses the reflective portion and the non-reflective portion of the sensed element, sending an input signal to the controller, incrementing the counter, tracking a number of times the spring is used, and indicating if the door is moving towards the open position or the closed position; and

wherein the sensed element and the spring cycle tracker are mounted at a height greater than 50% of the total height of the door when the door is in the closed position.

2. The system of claim **1** in which the spring cycle tracker is mounted to the door, and the sensed element is mounted adjacent to the door.

3. The system of claim **2**, in which the sensed element is mounted to the track.

4. The system of claim **2**, wherein the spring cycle tracker is mounted to the door at a height greater than 50% of the total height of the door when the door is in the closed position.

5. The system of claim **1** in which the sensed element is mounted to the door, and the spring cycle tracker is mounted adjacent to the door.

6. The system of claim **5**, in which the spring cycle tracker is mounted to the track.

7. The system of claim **5**, wherein the sensed element is mounted to the door at a height greater than 50% of the total height of the door when the door is in the closed position.

8. The system of claim **1**, wherein the sensed element further comprises another reflective material mounted in a first position relative to the reflective portion of the reflective material mounted in a second position on the track; and wherein the spring cycle tracker further comprises a first sensing element sensing the other reflective material and a second sensing element sensing the reflective portion of the reflective material, wherein the counter is increased when the other reflective material is sensed prior to the reflective portion of the reflective material.

9. The system of claim **1**, wherein the counter is resettable.

10. The system of claim **1**, wherein the spring cycle tracker further comprises an alarm coupled to the controller, wherein the alarm is activated by the controller when the number of cycles on the counter exceeds a selected number.

11. The system of claim **10**, wherein the alarm is visual.

12. The system of claim **10**, wherein the alarm is audible.

13. The system of claim **10**, wherein the alarm is resettable.

* * * * *